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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>C12N 15/31, C07K 14/22, 16/12, C12Q 1/68, A61K 39/095, G01N 33/50</b>		(11) International Publication Number: <b>WO 99/57280</b>
A3		(43) International Publication Date: 11 November 1999 (11.11.99)
(21) International Application Number: PCT/US99/09346		(US). MASIGNANI, Vega [IT/IT]; Chiron S.p.A., Via Fiorentina, 1, I-53100 Siena (IT). MORA, Marirosa [IT/IT]; Chiron S.p.A., Via Fiorentina, 1, I-53100 Siena (IT). PETERSEN, Jeremy [US/US]; Arlington, VA (US). PIZZA, Mariagrazia [IT/IT]; Chiron S.p.A., Via Fiorentina, 1, I-53100 Siena (IT). RAPPUOLI, Rino [IT/IT]; Chiron S.p.A., Via Fiorentina, 1, I-53100 Siena (IT). RATTI, Giulio [IT/IT]; Chiron S.p.A., Via Fiorentina, 1, I-53100 Siena (IT). SCALATO, Enzo [IT/IT]; Chiron S.p.A., Via Fiorentina, 1, I-53100 Siena (IT). SCARSELLI, Maria [IT/IT]; Chiron S.p.A., Via Fiorentina, 1, I-53100 Siena (IT). TETTELIN, Herve [US/US]; Gaithersburg, MD (US). VENTER, J., Craig [US/US]; Rockville, MD (US).  (74) Agent: HARBIN, Alisa, A.; Chiron Corporation, Intellectual Property - R440, P.O. Box 8097, Emeryville, CA 94662-8097 (US).  (81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  Published With international search report.  (88) Date of publication of the international search report: 24 August 2000 (24.08.00)
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(30) Priority Data: 60/083,758 1 May 1998 (01.05.98) US 60/094,869 31 July 1998 (31.07.98) US 60/098,994 2 September 1998 (02.09.98) US 60/099,062 2 September 1998 (02.09.98) US 60/103,749 9 October 1998 (09.10.98) US 60/103,794 9 October 1998 (09.10.98) US 60/103,796 9 October 1998 (09.10.98) US 60/121,528 25 February 1999 (25.02.99) US		
(71) Applicants (for all designated States except US): CHIRON CORPORATION [US/US]; 4560 Horton Street, Emeryville, CA 94608 (US). THE INSTITUTE FOR GENOMIC RESEARCH [US/US]; 9212 Medical Center Drive, Rockville, MD 20850 (US).		
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(54) Title: NEISSERIA MENINGITIDIS ANTIGENS AND COMPOSITIONS

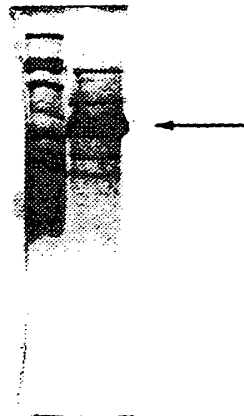
(57) Abstract

The invention provides proteins from Neisseria meningitidis, including the amino acid sequences and the corresponding nucleotide sequences. The proteins are predicted to be useful antigens for vaccines and/or diagnostics.

919 (46 kDa)

PURIFICATION

M1 919



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# INTERNATIONAL SEARCH REPORT

International Application No  
PC 1/US 99/09346

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C12N15/31  
G01N33/50

C07K14/22

C07K16/12

C12Q1/68

A61K39/095

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 C12N C07K C12Q A61K G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>DATABASE TREMBL [Online] EMBL ID Q55666, AC Q55666, 1 November 1996 (1996-11-01) TABATA S: "Membrane-bound lytic transglycosylase A MltA Synechocystis sp. strain PCC 6803" XP002130156 Note: 100% aa seq identity of aa 342-350 with aa 392-400 of SEQ ID NOs 2790 and 2792, 27.6% (26.9%) aa seq identity with SEQ ID NO:2790 (2792) in 370 (387) aa overlap. the whole document</p> <p style="text-align: center;">---</p> <p style="text-align: center;">-/--</p>	1,4-6,9, 12

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

26 May 2000

Date of mailing of the international search report

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INTE TIONAL SEARCH REPORT

International Application No

PC./US 99/09346

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 818 465 A (BIOLOG MOLECULAIRE DES PLANTES ;INST OF MOLECULAR BIOTECHNOLOG (DE) 14 January 1998 (1998-01-14) Note: 100% nt seq identity of nt 367951-367961 of SEQ ID NO:1 with nt 163-173 of SEQ ID NO:2789. page 108	8,11,12
A	--- LOMMATZSCH J ET AL.: "Outer membrane localization of murein hydrolases: MltA, a third lipoprotein lytic transglycosylase in Escherichia coli" JOURNAL OF BACTERIOLOGY, vol. 179, no. 17, September 1997 (1997-09), pages 5465-5470, XP002130154 Note: 33.7% (35.7%) aa seq identity with SEQ ID NO:2790 (2792) in 273 (207) aa overlap. abstract	1-12
A	--- DILLARD J P ET AL.: "A peptidoglycan hydrolase similar to bacteriophage endolysins acts as an autolysin in Neisseria gonorrhoeae" MOLECULAR MICROBIOLOGY, vol. 25, no. 5, September 1997 (1997-09), pages 893-901, XP000878964 abstract	1-12
A	--- WO 96 29412 A (IAF BIO VAC INC ;BRODEUR BERNARD R (CA); MARTIN DENIS (CA); HAMEL) 26 September 1996 (1996-09-26) cited in the application the whole document examples 1-12	1-18
A	--- WO 94 08013 A (OREGON STATE) 14 April 1994 (1994-04-14) the whole document examples 1-7	1-18
A	--- WO 92 13871 A (UNIV WASHINGTON) 20 August 1992 (1992-08-20) the whole document examples 1-10	1-18
A	--- BLAKE M S ET AL.: "Vaccines for gonorrhoea: where are we on the curve?" TRENDS IN MICROBIOLOGY, vol. 3, no. 12, December 1995 (1995-12), pages 469-474, XP000876514 the whole document --- -/--	1-18

# INTERNATIONAL SEARCH REPORT

International Application No

PL./US 99/09346

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	POOLMAN J T: "Development of a meningococcal vaccine" INFECTIOUS AGENTS AND DISEASE, vol. 4, no. 1, March 1995 (1995-03), pages 13-28, XP000876540 the whole document	1-18
X	WO 96 01901 A (RHONE POULENC RORER SA ;BLANC VERONIQUE (FR); THIBAUT DENIS (FR);) 25 January 1996 (1996-01-25) Note: 100% nt seq ident of bp 170-156 of SEQ ID NO:1 (rev DNA) with bp 202-216 of SEQ ID NO:1 (61.2% in 348 bp overlap), 40.7% seq ident of transl SEQ ID NO:1 with SEQ ID NO:2 in 118 aa overlap. page 102-104 example 1	8,11,12
X	WO 97 37044 A (ASTRA AB ;ALM RICHARD A (US); SMITH DOUGLAS (US)) 9 October 1997 (1997-10-09) Note: 100% aa seq identity of aa 204-211, 186-193 & 352-359 of transl SEQ ID NOs 227, 345 & 1003, resp., with aa 59-66 of SEQ ID NO:2, 37.4% aa seq identity with SEQ ID NO:2 in 115 aa overlap. page 268-269 page 344 page 909-910 page 23, paragraph B.4	4,12-14
X	DATABASE SWISSPROT [Online] ID YPCP YEREN, AC P31485, 1 July 1993 (1993-07-01) BAEUMLER A J ET AL.: "Hypothetical 29.6 kD protein in PCP 5' region (ORF1)" XP002138650 Note: 100% aa seq identity of aa 148-159 with aa 140-151 of SEQ ID NO:442, 43.4% aa seq identity with SEQ ID NO:442 in 256 aa overlap. the whole document	4,12
A	-& BAUMLER A J ET AL.: "A lipoprotein of Yersinia enterocolitica facilitates ferrioxamine uptake in Escherichia coli" JOURNAL OF BACTERIOLOGY, vol. 174, no. 3, February 1992 (1992-02), pages 1029-1035, XP000907295 page 1031, left-hand column, line 11 -right-hand column, line 15	4,12

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# INTERNATIONAL SEARCH REPORT

International Application No

PL, /US 99/09346

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>DATABASE SWISSPROT [Online]  ID YDHH_HAEIN, AC P44861,  1 November 1995 (1995-11-01)  FLEISCHMANN R D ET AL.: "Hypothetical  protein HI0753"  XP002138651  Note: 100% aa seq identity of aa 143-156  with aa 140-153 of SEQ ID NO:442, 41.6% aa  seq identity with SEQ ID NO:442 in 377 aa  overlap.  the whole document</p>	4,12
X	<p>---  WO 96 33276 A (HUMAN GENOME SCIENCES INC  ;UNIV JOHNS HOPKINS (US))  24 October 1996 (1996-10-24)  Note: 100% nt seq identity of bp  816794-816807 with bp 289-302 of SEQ ID  NO:441 (54.3% in 484 bp overlap), 100% aa  seq identity of translated sequence with  SEQ ID NO:442 in 14 aa overlap.  page 77.488  Note: 100% nt seq identity of bp  230516-230526 with bp 1501-1511 of SEQ ID  NO:489 (57.4% in 1292 bp overlap), 100% aa  seq identity of translated sequence with  SEQ ID NO:490 in 13 aa overlap.  page 77.139  page 76.37, line HI0215  Note: 100% nt seq identity of bp  1025409-1025418 with bp 1339-1330 (rev  strand) of SEQ ID NO:1201 (72.0% in 50 bp  overlap).  page 77.612</p>	4,8, 11-14
X	<p>---  CONLIN C A ET AL.: "Escherichia coli prlC  encodes an endopeptidase and is homologous  to the Salmonella typhimurium opdA gene"  JOURNAL OF BACTERIOLOGY,  vol. 174, no. 18,  September 1992 (1992-09), pages 5881-5997,  XP000907300  Note: 100% nt seq ident of bp 1824-1837  with bp 1480-1493 of SEQ ID NO:489 (59.7%  in 1282 bp overlap), 100% aa seq ident of  aa 495-507 with aa 492-504 of SEQ ID  NO:490 (49.5% in 679 aa overlap).  abstract  figure 2</p> <p>---  -/--</p>	4,8,11, 12

## INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>DATABASE SWISSPROT [Online]  ID OPDA_HAEIN, AC P44573,  1 November 1995 (1995-11-01)  FLEISCHMANN R D ET AL.: "Oligopeptidase A  (EC 3.4.24.70)"  XP002138652  Note: 100% aa seq identity of aa 496-508  with aa 492-504 of SEQ ID NO:490, 49.0% aa  seq identity in 677 aa overlap.  the whole document</p> <p>---</p>	4,12
X	<p>ROKBI B ET AL.: "Evaluation of  recombinant transferrin - binding protein  B variants from Neisseria meningitidis for  their ability to induce cross-reactive and  bactericidal antibodies against a  genetically diverse collection of  serogroup B strains."  INFECTION AND IMMUNITY,  vol. 65, no. 1, January 1997 (1997-01),  pages 55-63, XP002138643  abstract</p> <p>---</p>	5
P,A	<p>DATABASE TREMBL [Online]  EMBL  ID 069750, AC 069750,  1 August 1998 (1998-08-01)  ROKBI B ET AL.: "Transferrin binding  protein B, TbpB, Neisseria meningitidis"  XP002138653  Note: 22.3% aa seq identity with SEQ ID  NO:1202 in 488 aa overlap.  the whole document</p> <p>---</p>	4,8, 12-15,17
A	<p>-&amp; ROKBI B ET AL.: "Heterogeneity of  tbpB, the transferrin-binding protein B  gene, among serogroup B Neisseria  meningitidis strains of the ET-5 complex"  CLINICAL AND DIAGNOSTIC LABORATORY  IMMUNOLOGY,  vol. 4, no. 5, September 1997 (1997-09),  pages 522-529, XP002138644  abstract</p> <p>---</p> <p>-/--</p>	5,8, 12-15,17

# INTERNATIONAL SEARCH REPORT

International Application No

PLI/US 99/09346

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DATABASE GCG_GENESSEQ [Online]  ID W14640, AC W14640,  5 March 1998 (1998-03-05)  QUENTIN-MILLET M J ET AL.: "N.  meningitidis HTR Tbp2 (del3777-385,  del407-465, del488-508)"  XP002138654  Note: 23.5% aa seq identity with SEQ ID  NO:1202 in 571 aa overlap.  the whole document</p>	4,8, 12-15,17
A	<p>-&amp; WO 97 13860 A (PASTEUR MERIEUX SERUMS  VACC; QUENTIN MILLET MARIE JOSE (FR);  ROKBI)) 17 April 1997 (1997-04-17)  claim 11</p>	4,8, 12-15,17
X	<p>---  DATABAS E EMPRO1 [Online]  EMBL  ID AF034831, AC AF034831,  4 December 1997 (1997-12-04)  YOU Z ET AL.: "Rhizobium etli stomatin  like protein (slp) gene, complete cds."  XP002138655  Note: 100% nt seq ident of bp 4384-4395  with bp 529-540 of SEQ ID NO:1455 (54.4%  in 638 bp overlap), 100% aa seq ident of  aa 1394-1403 with aa 109-118 of SEQ ID  NO:1456 (41.2% in 182 aa overlap).  the whole document</p>	4,8,11, 12
P,X	<p>-&amp; YOU Z ET AL.: "A stomatin-like protein  encoded by the slp gene of Rhizobium etli  is required for nodulation competitiveness  on the common bean"  MICROBIOLOGY,  vol. 144, no. 9, September 1998 (1998-09),  pages 2619-2627, XP000907294  abstract  figure 2</p>	4,8,11, 12
X	<p>---  HUANG M ET AL.: "A stomatin-like protein  necessary for mechanosensation in C.  elegans"  NATURE,  vol. 378, no. 6554,  16 November 1995 (1995-11-16), pages  292-295, XP002138646  Note: 100% aa seq identity of aa 233-239  with aa 110-117 of SEQ ID NO:1456, 29.9%  aa seq identity in 234 aa overlap.  abstract  figure 1</p> <p style="text-align: center;">--- -/--</p>	4,12



# INTERNATIONAL SEARCH REPORT

International Application No

PC, /US 99/09346

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WONG C Y ET AL.: "Cloning and characterization of two immunophilin-like genes, ilpA and fkpA, on a single 3.9-kilobase fragment of Aeromonas hydrophila genomic DNA"</p> <p>JOURNAL OF BACTERIOLOGY, vol. 179, no. 11, June 1997 (1997-06), pages 3397-3403, XP002138647</p> <p>Note: 100% nt seq ident of bp 2659-2672 with bp 613-626 of SEQ ID NO:1745 (59.2% in 655 bp overlap), 100% aa seq ident of aa 205-216 with aa 200-211 of SEQ ID NO:1746 (44.9% in 265 aa overlap).</p> <p>abstract figure 2</p>	4,8, 11-14
X	<p style="text-align: center;">---</p> <p>DATABASE EMPRO2 [Online]</p> <p>EMBL</p> <p>ID NE01198, AC U001198, 23 November 1993 (1993-11-23)</p> <p>MCALLISTER C F ET AL.: "Neisseria elongata NRL FKBP immunophilin homolog gene"</p> <p>XP002138656</p> <p>Note: 100% nt seq identity of bp 125-138 with bp 635-648 of SEQ ID NO:1745 (65.8% nt seq identity in 237 bp overlap).</p> <p>the whole document</p>	8,11,12
X	<p>-&amp; MCALLISTER C F ET AL.: "Analysis in Neisseria meningitidis and other Neisseria species homologous to the FKBP immunophilin family"</p> <p>MOLECULAR MICROBIOLOGY, vol. 10, no. 1, October 1993 (1993-10), pages 13-23, XP000907304</p> <p>abstract figure 3</p>	8,11,12
X	<p style="text-align: center;">---</p> <p>SAMPSON B A ET AL.: "Neisseria meningitidis encodes an FK506-inhibitable rotamase"</p> <p>PROC. NAT'L. ACAD. SCI. USA, vol. 89, no. 4, 15 February 1992 (1992-02-15), pages 1164-1168, XP002138648</p> <p>Note: 100% nt seq identity of bp 278-288 (284-294) with bp 719-729 of SEQ ID NO:1745 (60.5% nt seq identity in 281 bp overlap).</p> <p>abstract figure 2</p> <p style="text-align: center;">---</p> <p style="text-align: center;">-/--</p>	8,11,12

# INTERNATIONAL SEARCH REPORT

International Application No

PL/US 99/09346

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HACKER J ET AL.: "Immunophilins: structure-function relationship and possible role in microbial pathogenicity." MOLECULAR MICROBIOLOGY, vol. 10, no. 3, November 1993 (1993-11), pages 445-456, XP000907321 abstract ---	13,14,17
X	DATABASE EMPR01 [Online] EMBL ID ECUW93, AC U14003 (partial), 30 November 1994 (1994-11-30) BURLAND V ET AL.: "Escherichia coli K-12 chromosomal region from 92.8 to 00.1 minutes" XP002138657 Note: 100% nt seq identity of bp 37827-37839 with bp 1186-1174 of SEQ ID NO:2791. page 4 -----	8,11,12

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 99/09346

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:  
1,3,16,18 (all completely); 2,4-15,17 (all partially). Inventions searched:  
#1 (SEQ ID NOs 2789/2790), #2 (1/2), #222 (441/442), #246 (489/490), #602 (1201/1202), #729 (1455/1456), #874 (1745/1746), #1397 (2791/2792)
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

Invention 1. Claims: 1,3,16,18 (all completely); 2,4-15,17 (all partially)

A protein comprising the amino sequence of SEQ ID NO:2790 or comprising a fragment of at least 7 (preferably consecutive) amino acids of said SEQ ID NO; a protein with 50% or greater homology to said protein(s); an antibody binding to said protein(s); a nucleic acid encoding said protein(s), preferably comprising the nucleotide sequence of SEQ ID NO:2789 or a fragment comprising 10 or more consecutive nucleotides thereof; complementary nucleic acid molecules; compositions comprising said protein(s), nucleic acid(s) or antibody for vaccination, diagnosis or pharmaceutical use, preferably immunogenic compositions comprising said protein(s), and the use of said composition(s).

Invention 2. Claims: 2,4-15,17 (all partially)

A protein comprising an amino sequence according to SEQ ID NO:2 or comprising a fragment of at least 7 consecutive amino acids of said SEQ ID NO; an antibody binding to said protein(s); a nucleic acid encoding said protein(s), preferably comprising a nucleotide sequence according to SEQ ID NO:1 or a fragment comprising 10 or more consecutive nucleotides thereof; complementary nucleic acid molecules; compositions comprising said protein(s), nucleic acid(s) or antibody for vaccination, diagnosis or pharmaceutical use, preferably immunogenic compositions comprising said protein(s), and the use of said composition(s).

Inventions 3-1510. Claims: 2,4,-15,17 (all partially)

Same as invention 2 but for proteins limited to the even-numbered SEQ ID NOs:4-3020 except 2790, and for nucleic acids limited to the corresponding odd-numbered SEQ ID NOs:3-3019 except 2789. E.g., invention 3: limited to SEQ ID NO:4 and SEQ ID NO:3, invention 4: limited to SEQ ID NO:6 and SEQ ID NO:5, ... , invention 1509: limited to SEQ ID NO:3018 and SEQ ID NO:3017, and invention 1510: limited to SEQ ID NO:3020 and SEQ ID NO:3019.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PL./US 99/09346

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0818465 A	14-01-1998	EP 0917582 A	26-05-1999
		WO 9802560 A	22-01-1998
WO 9629412 A	26-09-1996	AU 716225 B	24-02-2000
		AU 4934396 A	08-10-1996
		BR 9607651 A	17-11-1998
		CA 2215161 A	26-09-1996
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